



Research Opportunities with the Spitzer Space Telescope

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Spitzer Talk Outline



- ◆ Mission Overview (Further details can be found in Spitzer Special Issue of the Astrophysical Journal Supplement Series, v. 154, 2004.)
- ◆ A Smattering of Science Highlights
- ◆ Science Proposal Opportunities



Spitzer Summary



Launch Date:	25 August 2003
Launch Vehicle/Site:	Delta 7920H ELV / Cape Canaveral, Florida
Estimated Lifetime:	Almost 6 years
Orbit:	Earth-trailing, Heliocentric
Wavelength Coverage:	3 - 180 microns
Telescope:	85 cm diameter, f/12 lightweight Beryllium, cooled to less 5.5 K
Diffraction Limit:	< 6.5 microns
Science Capabilities:	Imaging / Photometry, 3-180 microns Spectroscopy, 5-40 microns Spectrophotometry, 50-100 microns
Pointing accuracy (1- σ radial):	<0.5" blind, <0.2" offset, <0.1" stability
Planetary Tracking:	1 arc-sec / sec
Cryogen / Volume:	Liquid Helium / 360 liters
Launch Mass:	950 kg
Telecommunications:	DSN, 2 x 1 hr passes/day
Time Allocation:	20% GTO, 5% DDT, 75% GO
Legacy Programs:	6 selected

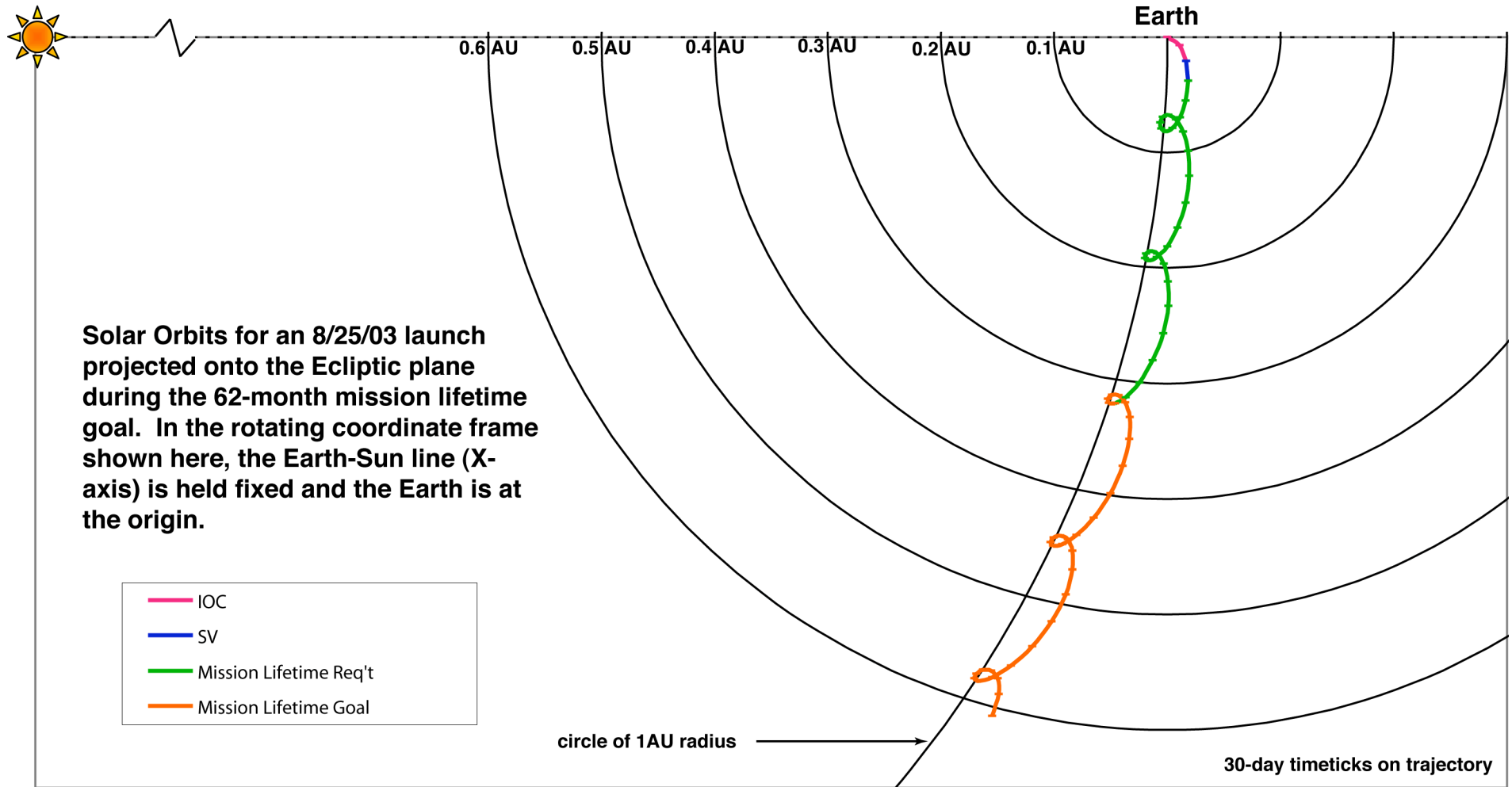


Delta Rocket and Launch





Spitzer Trajectory

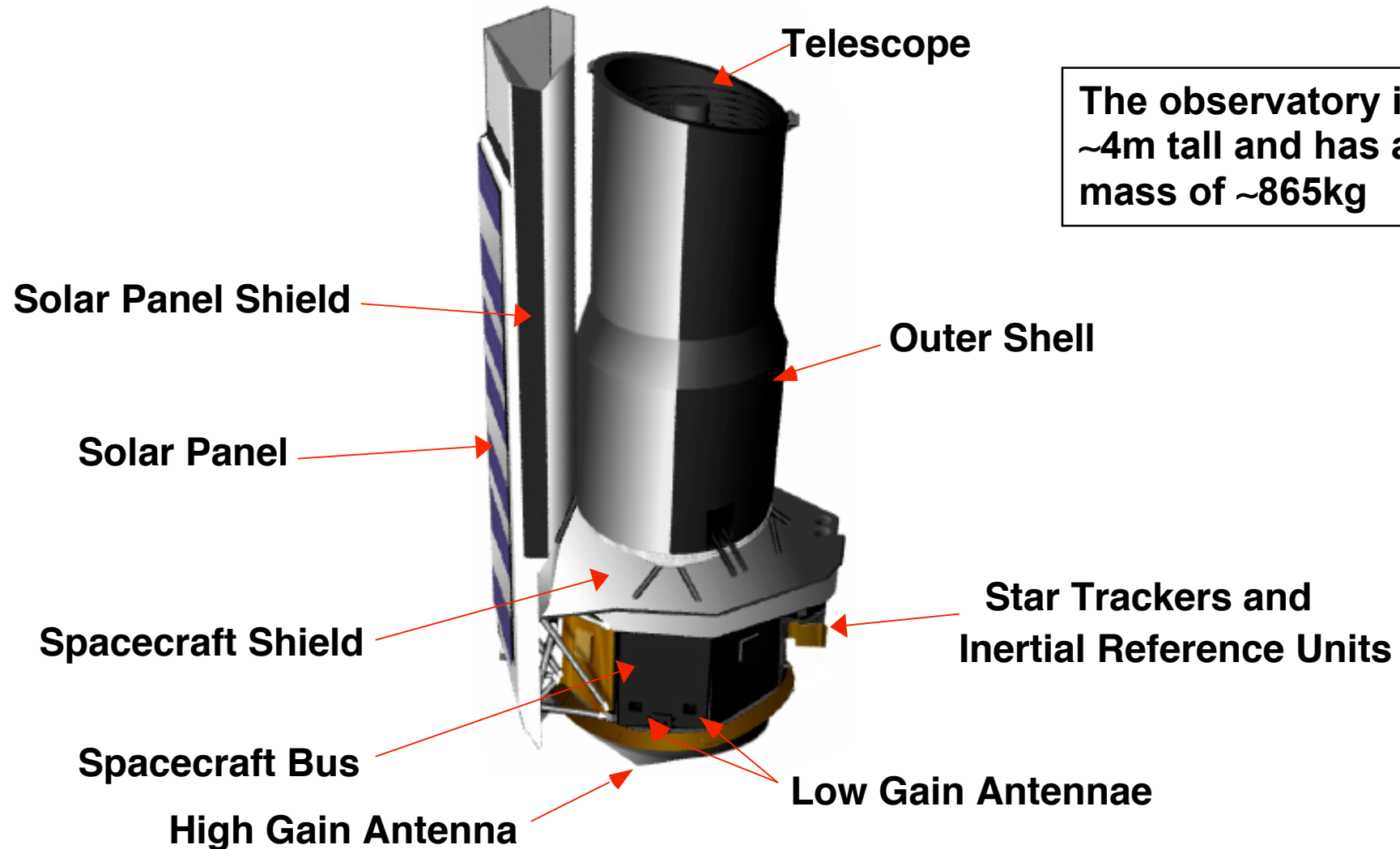




Observatory Configuration

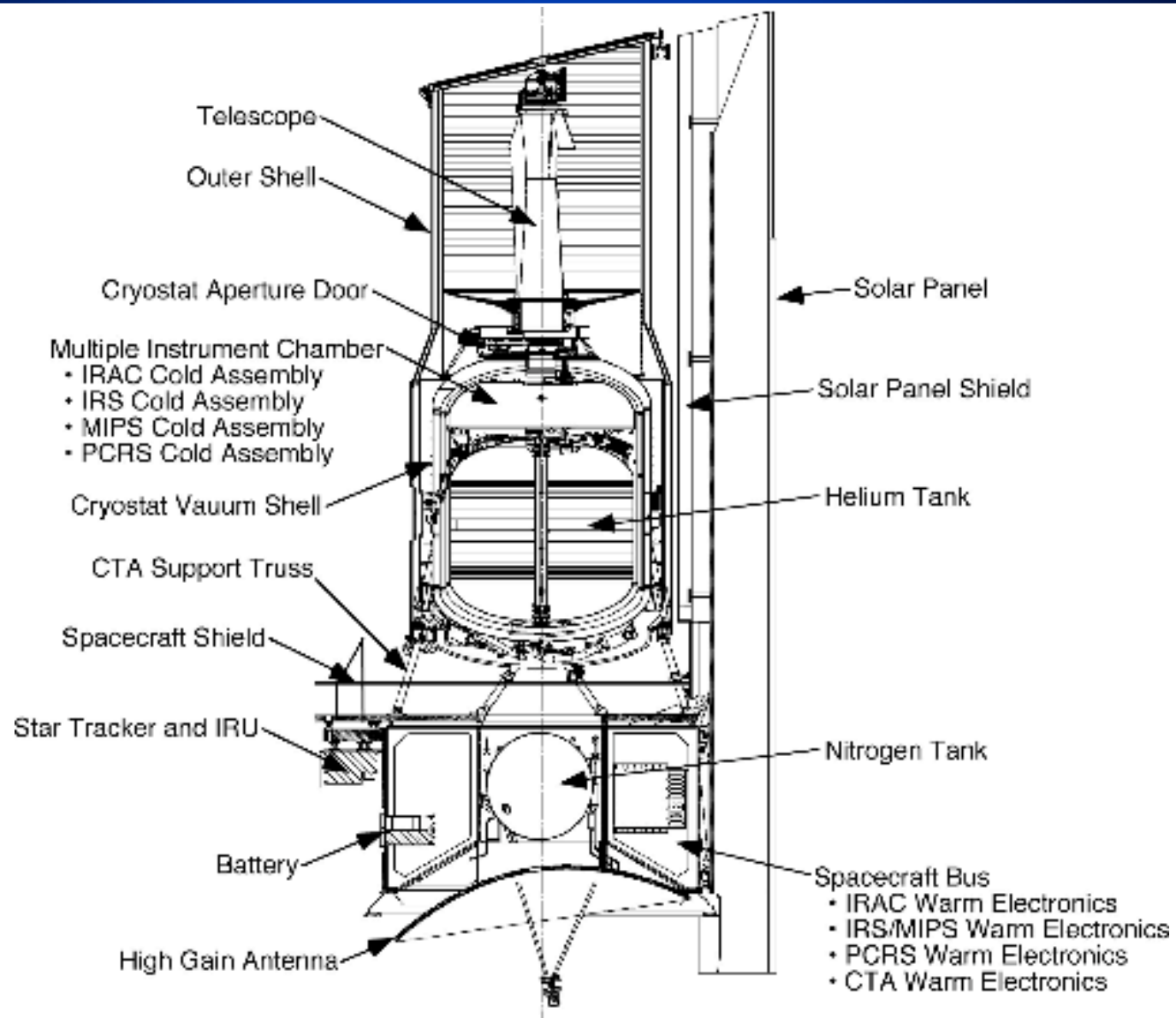


The observatory is
~4m tall and has a
mass of ~865kg





Spitzer Cut-Away View

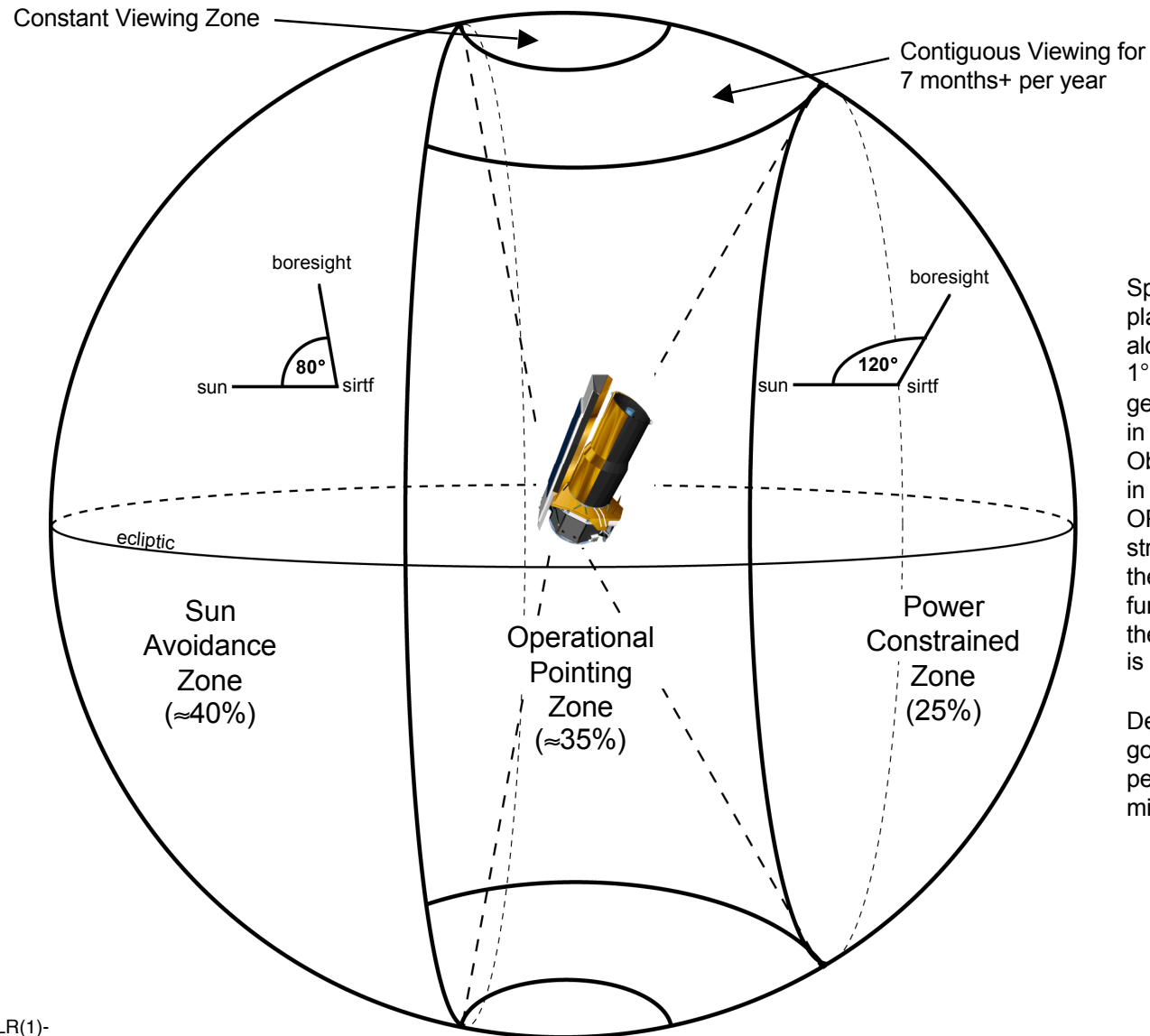




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Spitzer Instantaneous Sky Visibility



Spitzer's orbit about the Sun is nearly coplanar with the Ecliptic. The mean motion along this "solar orbit" is approximately 1° per day. In this orbit, Spitzer's main geometric observing constraints (as depicted in the unit sphere at left) arise because the Observatory's boresight must always point in the Operational Pointing Zone (OPZ). The OPZ keeps direct or reflected sunlight from striking any cold surface and assures that the solar arrays are well illuminated. To further ensure that sunlight is kept off of the cold surfaces, rotation about the boresight is also restricted (to be less than $\pm 2^\circ$).

Despite these constraints, Spitzer has very good coverage of the entire sky for long periods of time throughout the entire mission.



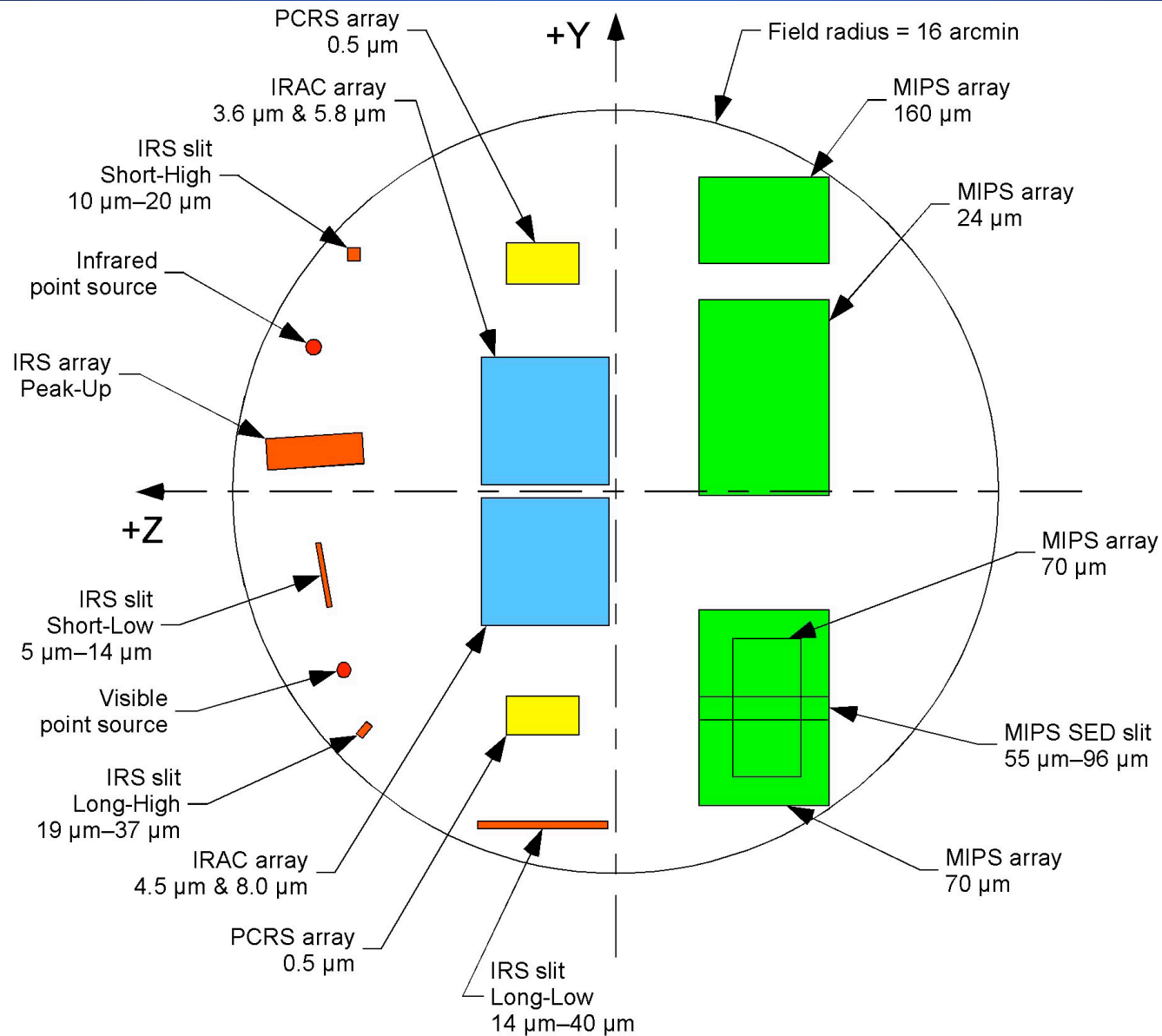
Spitzer Science Instruments Share the Focal Plane



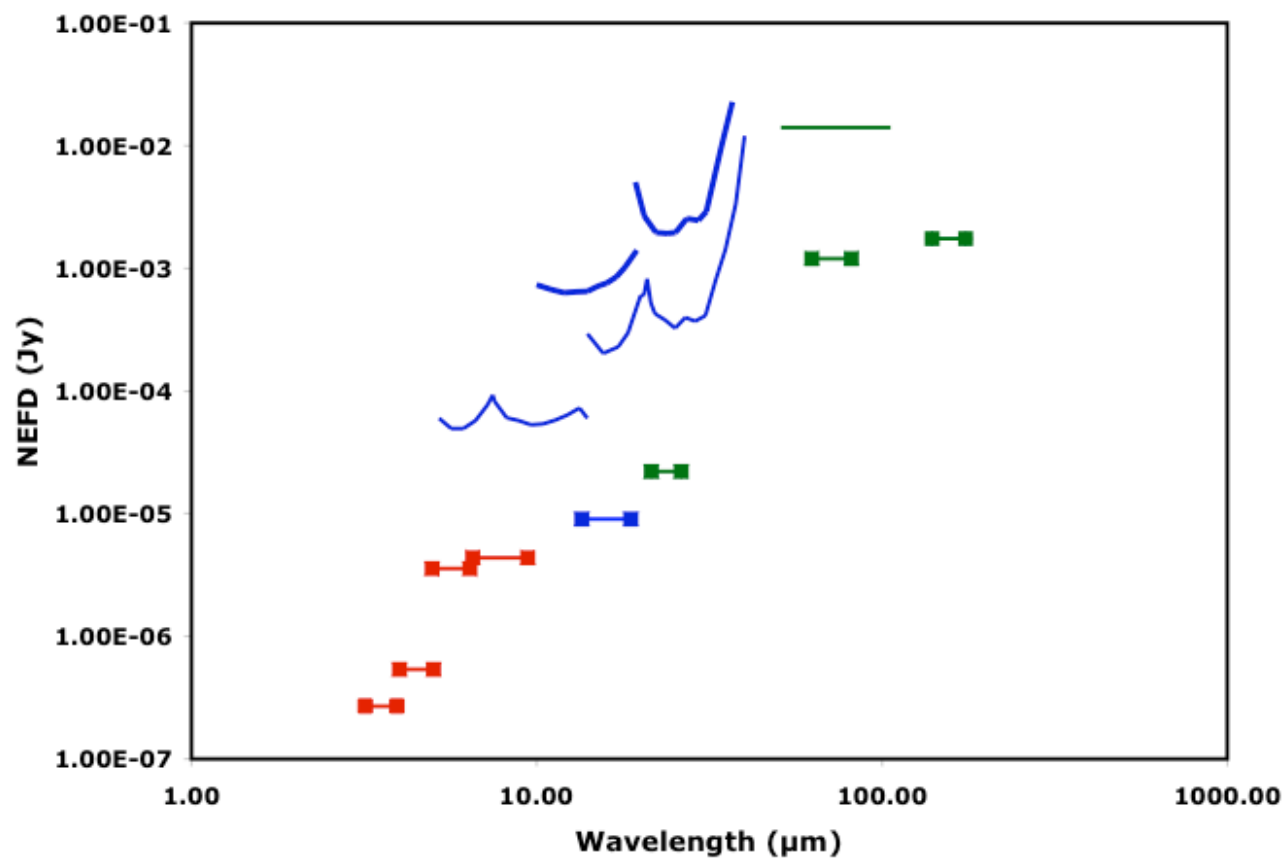
- ◆ Infrared Array Camera (IRAC)
 - *Near-IR camera with four 256x256 focal planes each covering 5'x5'*
 - *Wavelength coverage 3.6 μ m, 4.5 μ m, 5.8 μ m, 8.0 μ m - $R \sim 4$*
 - *Simultaneous co-spatial observations with 3.6/5.7 and 4.5/8.0*
- ◆ Infrared Spectrograph (IRS)
 - *Four modules covering 5.3 to 38 μ m*
 - *Two modules long-slit, $R \sim 64$ -128*
 - *Two modules $R \sim 600$*
 - *Peakup/imaging camera functions in two 16 μ m and 22 μ m*
- ◆ Multi-band Imaging Photometer for Spitzer (MIPS)
 - *Three arrays operating at 24 μ m, 70 μ m, 160 μ m*
 - *Optimized for very efficient scanning observations*
 - *$R \sim 15$ -25 spectroscopy at 55-95 μ m*



Spitzer Focal Plane



Spitzer Sensitivity



All 1- σ in 500 seconds

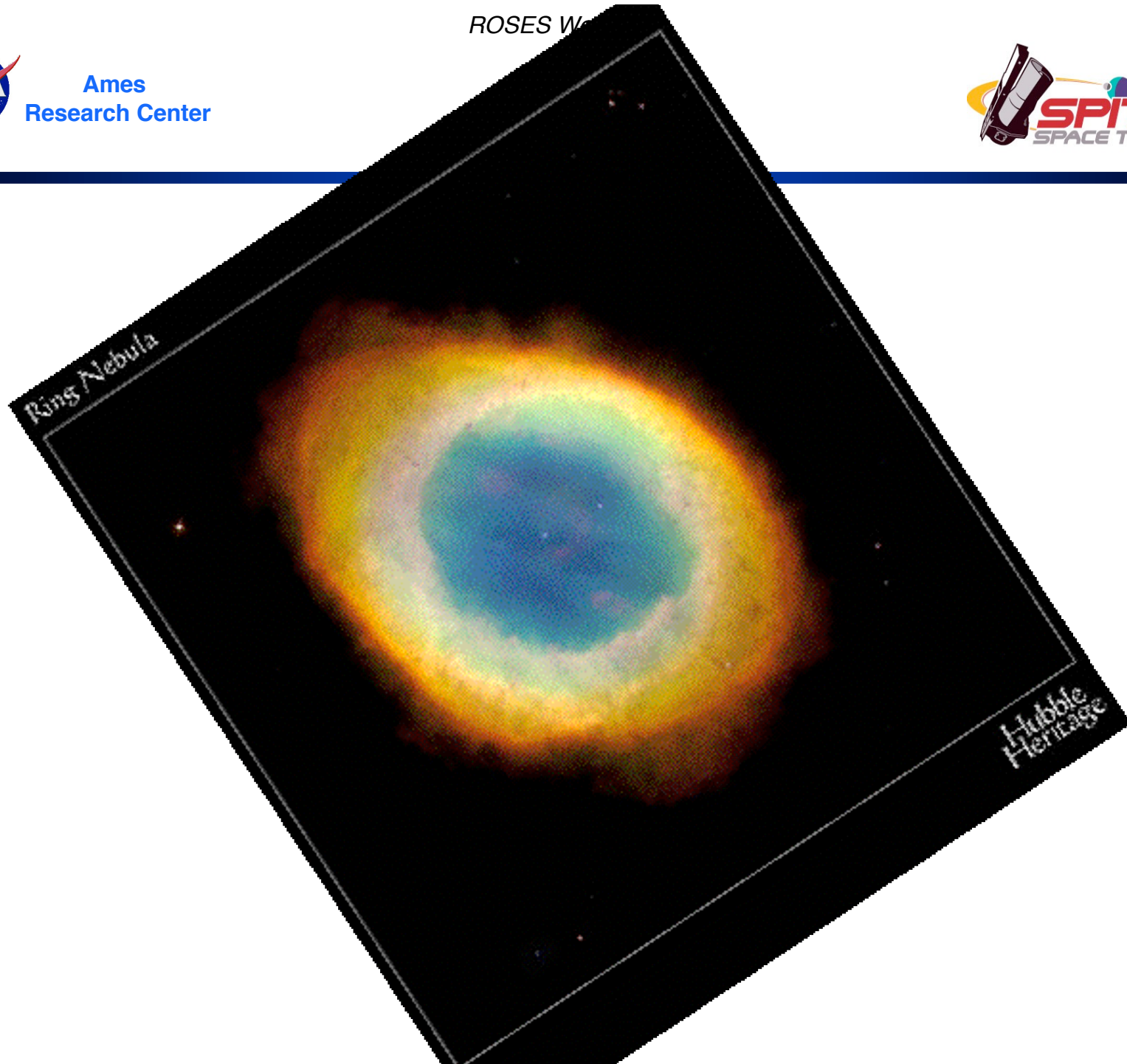
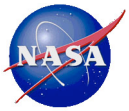


Ring Nebula/Messier 57

NASA / JPL-Caltech / J. Hora (Harvard-Smithsonian CfA)

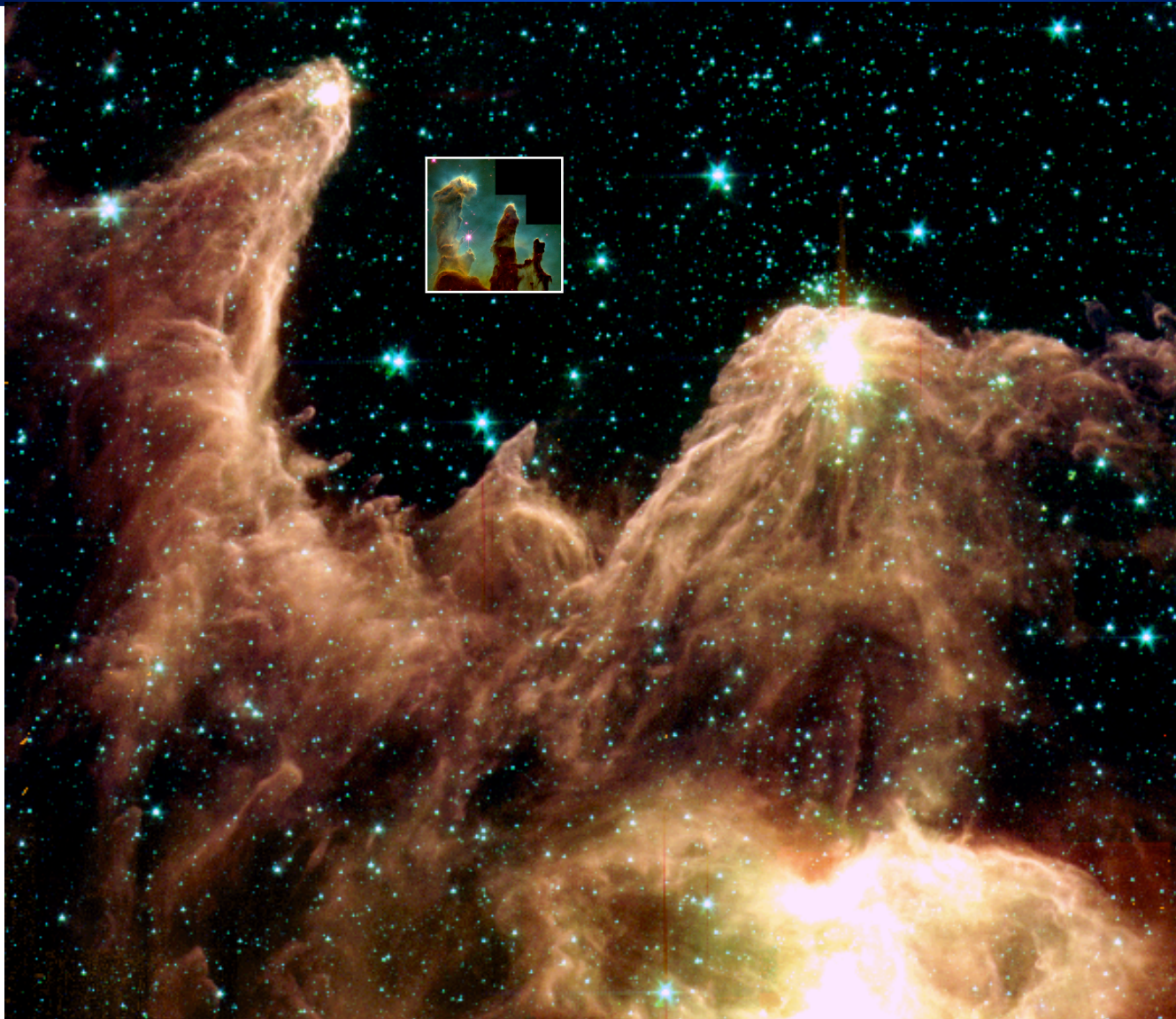
Spitzer Space Telescope • IRAC

ssc2005-07a

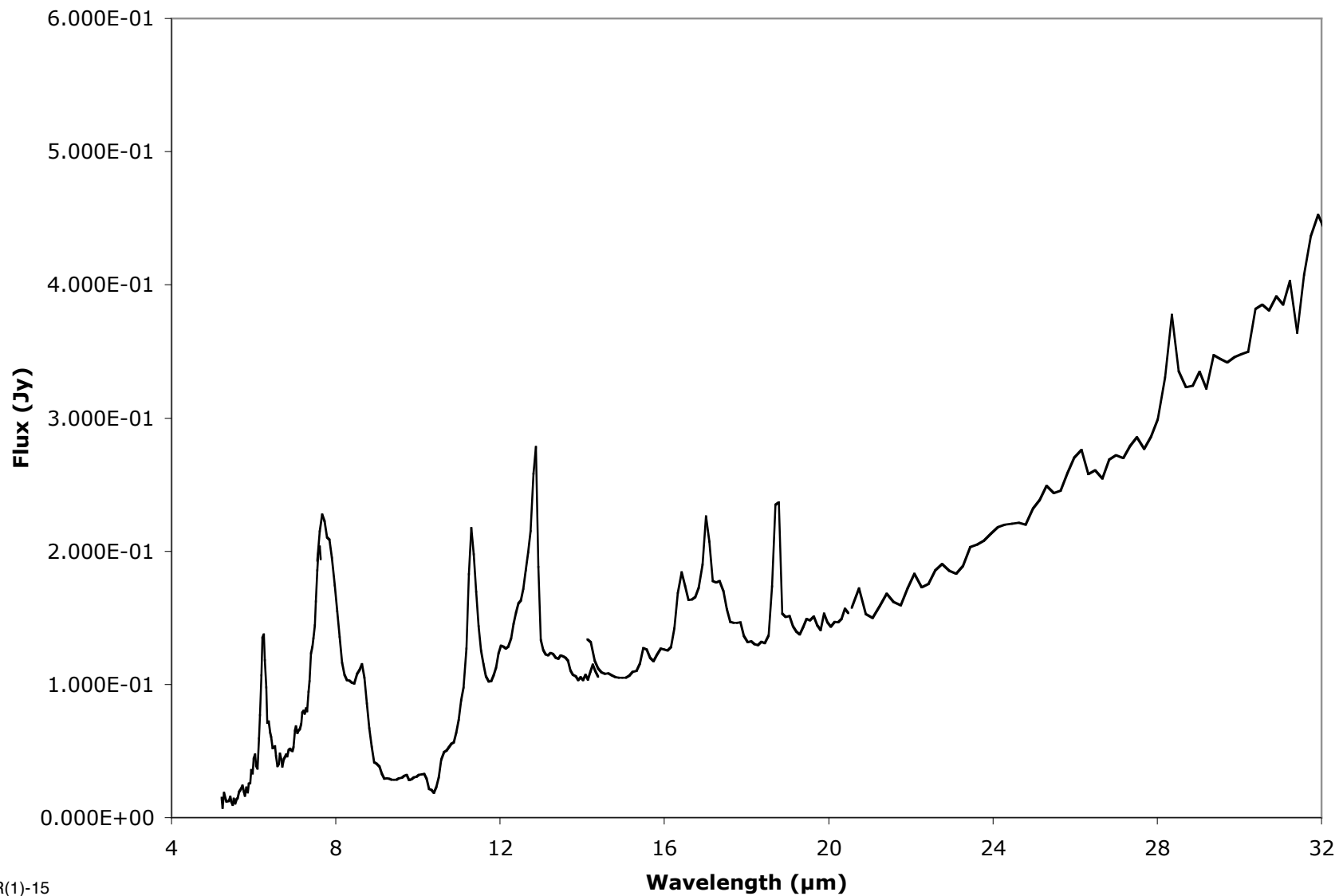




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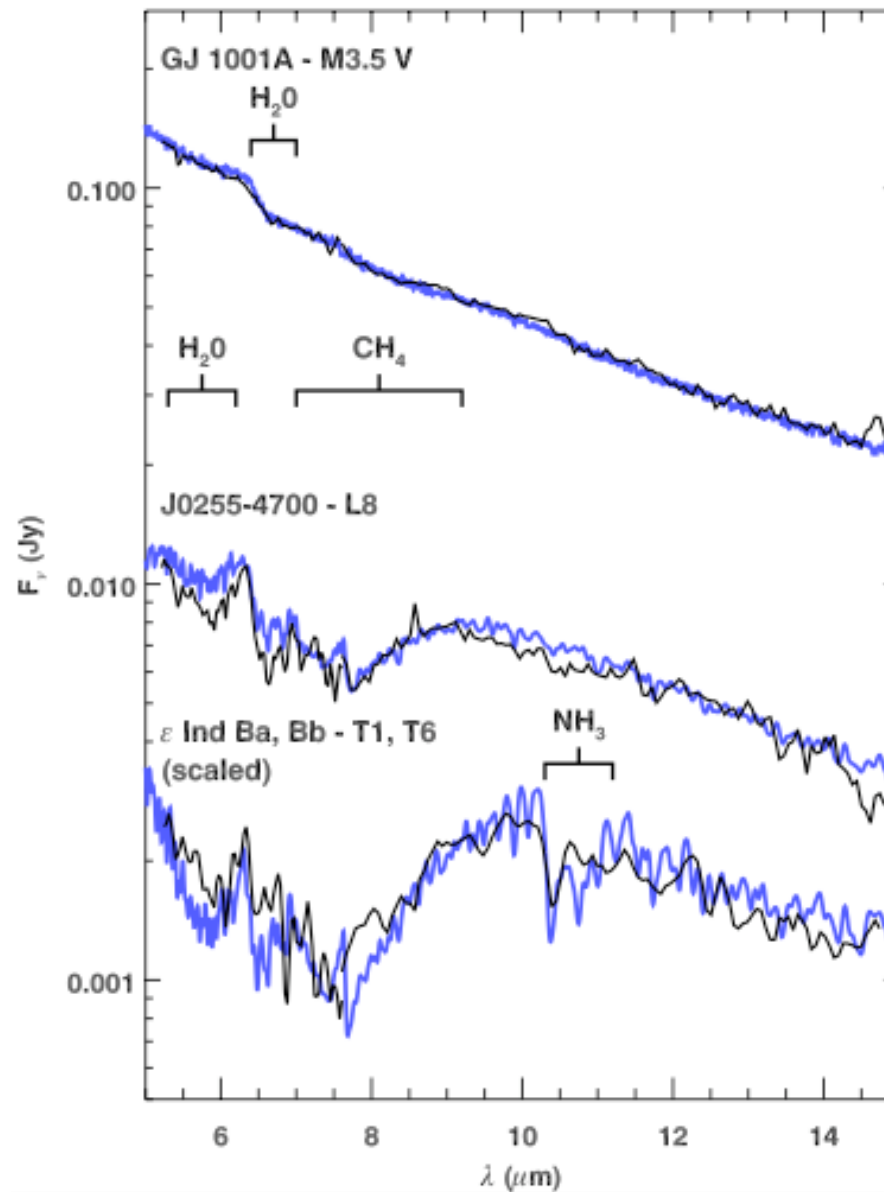


PAHs in Cirrus





Brown Dwarf Atmospheres



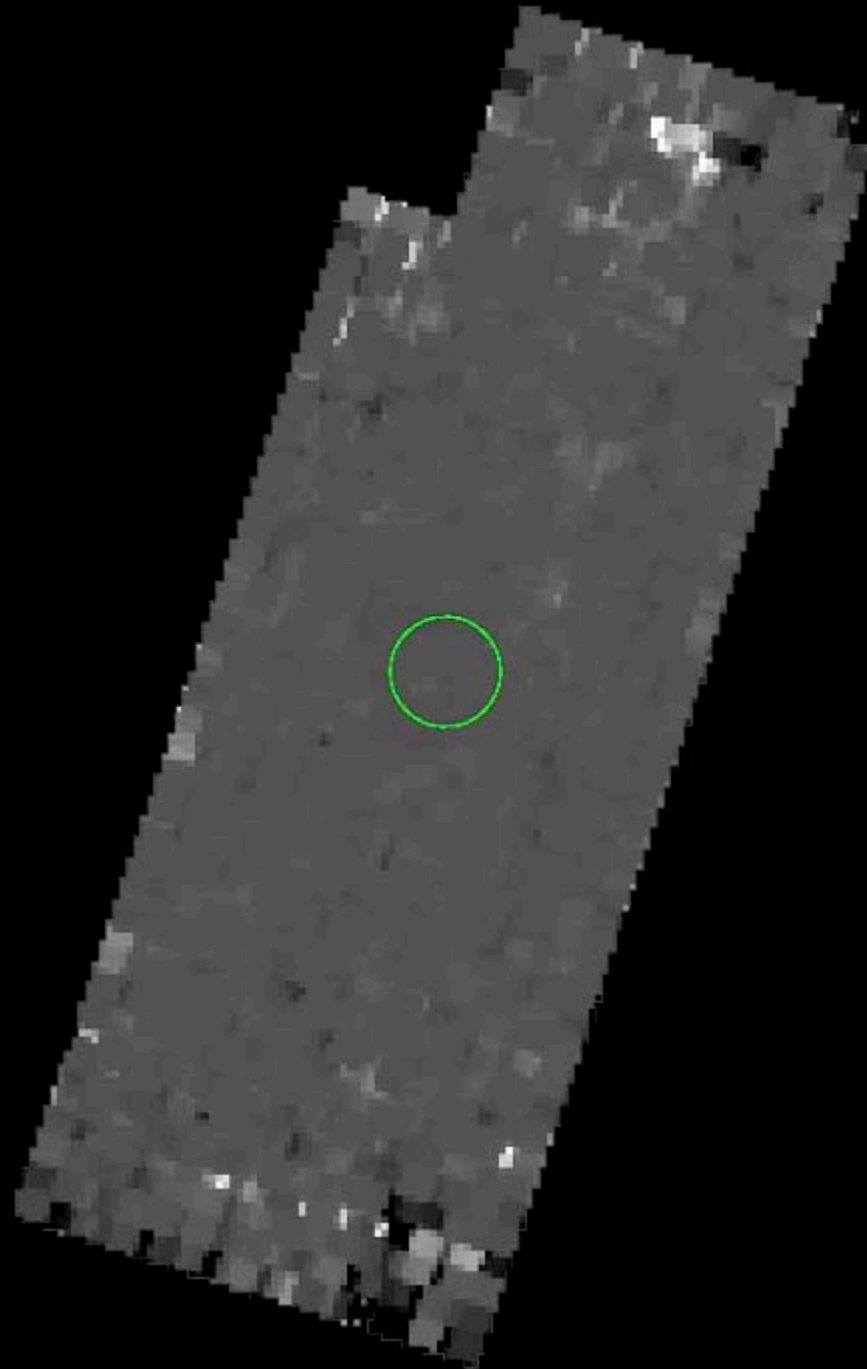


MIPS Rescues Pluto!





MIPS
Observation
of Sedna
(Stansberry et al.)





Sedna
800-1100 miles
in diameter



Quaoar
[800 miles]



Pluto
[1400 miles]



Moon
[2100 miles]



Earth
[8000 miles]

“Scientists used the fact that **even the Spitzer telescope was unable to detect the heat** of the extremely distant, cold object to determine that **it must be** no more than 1,700 kilometers (about 1,000 miles) in diameter, ***smaller than Pluto.*** “ - press release



Types of Spitzer Observing Time



- ◆ Guaranteed Time Observations
 - *20% of time in first 2.5 years, 15% of time thereafter*
 - *1 year proprietary period*
- ◆ Legacy Observations
 - *6 large programs (3160 hrs total) in first 1.5 yrs of mission, designed to provide a coherent data set for the Spitzer data archive*
 - *No proprietary period*
 - *Further details at: <http://ssc.spitzer.caltech.edu/legacy/>*
- ◆ Director's Discretionary Time
 - *5%, no proprietary period*
- ◆ General Observation Time
 - *Up to 75% of time*
 - *Both defined and targets of opportunity proposal accepted*
 - *1 year proprietary period*



Science Proposal Opportunities (<http://ssc.spitzer.caltech.edu>)



- ◆ General Observer (GO) Time
 - *Proposals submitted annually - last submission date was 2/12/05*
 - *Funding is with an algorithm with roughly \$4k/observing hour*
 - *~5,400 hours available in latest call for proposals*
 - *(~19,000 hrs proposed in 2/05 call)*
- ◆ Archive Research (AR)
 - *Research project using the Spitzer Data Archive*
 - *In particular, the results of the Spitzer Legacy programs will be available*
 - *Funding levels set by submitted cost plans, 1-year duration*
 - *(56 proposals received in 2/05 call)*
- ◆ Theoretical Research (TR)
 - *Needs to show direct relevance to Spitzer science*
 - *Funding levels set by submitted cost plans , 1-year duration*
 - *(17 proposals received in 2/05 call)*